

REMARKS

Reconsideration and withdrawal of the Examiner's rejection fo the above-identified application is respectfully requested in view of the foregoing amendments and following remarks. Claims 1 and 3-10 are in the application. Claims 1 and 9 have been amended. Claim 2 has been canceled. Claim 10 has been added. No new matter has been added.

The present invention according to amended claim 1 has the following features:

Crystallized glass which:

A: can be redrawn and

B: is formed by precipitating  $\beta$ -spodumene solid solution or  $\beta$ -quartz solid solution, and

C: having a composition containing, by mass percent, 55-72%  $\text{SiO}_2$ , 14-30%  $\text{Al}_2\text{O}_3$ , 2.9-6.0%  $\text{Li}_2\text{O}$ , and 1.0-10.0%  $\text{K}_2\text{O}$ , 1.0-5.0%  $\text{TiO}_2$ , 0-4.0%  $\text{ZrO}_2$ , 2.0-9.0%  $\text{TiO}_2+\text{ZrO}_2$ , 0-10.0%  $\text{ZnO}$ , 0-2.5%  $\text{MgO}$ , 0-4.0%  $\text{CaO}$ , 0-6.0%  $\text{BaO}$ , 0-7.0%  $\text{B}_2\text{O}_3$ , 0-4.0%  $\text{Na}_2\text{O}$ , and 0-8.0%  $\text{P}_2\text{O}_5$ , wherein a mass ratio between  $\text{Li}_2\text{O}$  and  $\text{K}_2\text{O}$  ( $\text{Li}_2\text{O}/\text{K}_2\text{O}$ ) is 2.2 or less.

The present invention according to claim 1 having the features A to C provides advantages a to d as follows:

a: Even if the content of  $\text{Li}_2\text{O}$  is large, a softening point thereof is not raised to enable highly precise redrawing.

b: A viscosity of a mother glass can be easily lowered and thus increase yield of redrawn products.

c: Since the softening point of the crystallized glass is lowered, to be precise, a temperature upon redrawing can be lowered so that deterioration of the redrawing facilities can be suppressed to improve the productivity of redrawing.

d: The crystallized glass article obtained by redrawing the crystallized glass of the present invention is applicable to an optical connector, an information communication component such as a fixed attenuator, or an electronic component.

Claims 1 and 4-9 are rejected as being anticipated by JP 2002154840. Applicant respectfully traverses.

The present invention according to amended claim 1 and JP 2002-154840 are similar in that both mention crystallized glass formed by precipitating  $\beta$ -spodumene solid solution or  $\beta$ -quartz solid solution. However, they differ from each other in devitrification of mother glass upon forming and in redrawability upon redrawing.

In JP 2002-154840, since the crystallized glass (Example 10) contains large amount of  $\text{TiO}_2$  such as 5.5%, the devitrification of the mother glass upon the redrawing increases. Therefore, in

the case of casting the mother glass as the embodiments of the present invention, devitrification stones occur upon the casting of the mother glass. The devitrification stones are larger than precipitated crystals in the crystallized glass. The devitrification stones remain without extinction upon the subsequent crystallizing. Therefore, not only high dimensional accuracy cannot be provided upon the redrawing of the crystallized glass but also the crystallized glass may be broken during the redrawing at worst and therefore the yield of redrawn product declines:

Furthermore, in the case that the content of  $\text{TiO}_2$  is great, the rate of crystallization overly increases (the ratio of a glass phase overly decreases) and therefore the crystallized glass becomes hard to soften and redraw and become impossible of highly precise redrawing.

In contrast, since the content of  $\text{TiO}_2$  is 1.0 to 5.0% in the present invention, the devitrification of the mother glass upon the redrawing is low. Consequently, in even the case of casting the mother glass, the devitrification stones are hard to occur and therefore the redrawing are performed with high dimensional accuracy.

Furthermore, the present invention provides a rate of crystallization suitable so that the crystallized glass becomes easy to soften and redraw and becomes enable to redraw in highly precise.

As just described, since JP 2002-154840 never mentions nor remotely suggests the features A and C according to claim 1 of the present invention, that is, the crystallized glass having a composition enabling redrawing. Consequently, JP 2002-154840 does not provide the advantages a to d of the present invention. Thus, the present invention according to claim 1 is not anticipated by JP 2002-154840.

Furthermore, since claims 4 to 10 depend on amended claim 1, the present inventions according to claims 4 to 10 also have the features A to C according to claim 1 of the present invention. Thus, the present inventions according to claims 4 to 10 are not the same as JP 2002-154840.

The Examiner rejected claims 1-9 under 35 USC 102 as being unpatentable over Ishida et al. Applicant respectfully traverses.

The present invention according to amended claim 1 and Ishida et al. (USP 6,060,412) are similar in that both mention

the crystallized glass can be redrawn. However, both are different from each other in the composition of the crystallized glass.

Although the crystallized glasses (Samples 7 and 8) having 2.9-6.0%  $\text{Li}_2\text{O}$  are mentioned in Ishida et al., the amount of  $\text{K}_2\text{O}$  contained in each of the crystallized glasses is not greater than 1.0 % so that the mass ratio of  $\text{Li}_2\text{O}/\text{K}_2\text{O}$  is very large such as 13.3.

Therefore, when Sample 7 is heated, the ratio of a glass phase greatly decreases by 25 vol % as shown in Table 4 and therefore the crystallization markedly progresses and thus even the softening point cannot be measured. Furthermore, when Sample 7 is evaluated regarding the redrawability, the crystallized glass is broken during the redrawing and many devitrification portions are observed on the surface (column 9, line 64 to column 10, line 24). As with Sample 8, since the ratio of the glass phase is extremely small, the softening point cannot be measured. In evaluate of Sample 8 in redrawability, the glass cannot be drawn because of insufficient softening and deforming (column 10, lines 25 to 29).

In contrast, since the mass ratio of  $\text{Li}_2\text{O}/\text{K}_2\text{O}$  is not greater than 2.2 in the present invention, even if the amount of  $\text{Li}_2\text{O}$  is

not less than 2.9 %, the crystal precipitation does not increase so that the softening point of the crystallized glass does not rise to thereby enable highly precise redrawing thereof, and further the crystallized glass can be excellent in mechanical strength and abrasion resistance and the lowered viscosity of the mother glass can be achieved. Further, since the softening point of the crystallized glass is not only prevented from rising, but lowered, to be specific, the temperature upon the redrawing can be lowered so that deterioration of the redrawing facilities can be suppressed to improve the productivity of the redrawing.

As just described, Ishida et al. never mentions nor remotely suggests the feature C according to claim 1 of the present invention, that is, that the ratio of  $\text{Li}_2\text{O}/\text{K}_2\text{O}$  is controlled when the amount of  $\text{Li}_2\text{O}$  is large so that the high precise redrawability is provided. Consequently, Ishida et al. does not provide the advantages a to d of the present invention. Thus, the present invention according to claim 1 is not obvious in view of Ishida et al.

Furthermore, since claims 3 to 10 depend on amended claim 1, the present inventions according to claims 3 to 10 also have the features A to C according to claim 1 of the present invention. Thus, the present inventions according to claims 3 to 10 are not obvious in view of Ishida et al.

The Examiner also rejected claims 1-9 under 35 USC 103 as being unpatentable over Mitachi et al. Applicant respectfully traverses.

The present invention according to amended claim 1 and Mitachi et al. (USP 6,170,995) are similar in that both mention the crystallized glass can be redrawn. However, both are different from each other in the composition of the crystallized glass.

Mitachi et al. mentions the crystallized glasses (Samples 9 and 10) having 2.9-6.0%  $\text{Li}_2\text{O}$ . However, the mass ratio of  $\text{Li}_2\text{O}/\text{K}_2\text{O}$  in Sample 9 is large such as the ratio of 2.25. When Sample 9 is heated, the glass phase decreases and the crystallization progresses. Therefore, the softening point rises and thus the drawing in high accuracy cannot be carried out. Furthermore, since Sample 10 has no  $\text{K}_2\text{O}$ , the ratio of a glass phase greatly decreases and therefore the crystallization markedly progresses, and thus even the softening point cannot be measured. In attempt to redraw such Sample 10, the crystallized glass is broken during the redrawing and many devitrification portions are observed on the surface.

As just described, since Mitachi et al. never mentions nor

remotely suggests the feature C according to claim 1 of the present invention, that is, that the ratio of  $\text{Li}_2\text{O}/\text{K}_2\text{O}$  is controlled when the amount of  $\text{Li}_2\text{O}$  is large so that the high precise redrawability is provided. Consequently, Mitachi et al. does not provide the advantages a to d of the present invention. Thus, the present invention never is obvious from Mitachi et al.

Furthermore, since claims 3 to 10 depend on amended claim 1, the present inventions according to claims 3 to 10 also have the features A to C according to claim 1 of the present invention. Thus, the present inventions according to claims 3 to 10 also never are obvious from Mitachi et al.

The Examiner also rejected claims 1-9 under 35 USC 103 as being unpatentable over Sakamoto et al. Applicant respectfully traverses.

The present invention according to amended claim 1 and Sakamoto et al. (EP 1 050 519) are similar in that both mention the crystallized glass can be redrawn.

However, Sakamoto et al. only mentions crystallized glass formed by heat-treating and crystallizing in a range of 800 to 1250, to precipitate  $\beta$ -spodumene solid solution,  $\beta$ -quartz solid solution, and so on, the glass containing a composition



containing, by mass percent, 60-75% SiO<sub>2</sub>, 15-28% Al<sub>2</sub>O<sub>3</sub>, 1.8-5% Li<sub>2</sub>O, and 0-10% K<sub>2</sub>O, 1.5-5% TiO<sub>2</sub>, and 0-4% ZrO<sub>2</sub> (page 3, lines 37 to 40) while Sakamoto et al. never mentions nor remotely suggests the crystallized glass in which a mass ratio of Li<sub>2</sub>O/K<sub>2</sub>O is 2.2 or less.

Namely, Sakamoto et al. never mentions nor remotely suggests the feature C according to claim 1 of the present invention, that is, that the ratio of Li<sub>2</sub>O/K<sub>2</sub>O is controlled when the amount of Li<sub>2</sub>O is large so that the high precise redrawability is provided. Thus, the present invention is not obvious from Sakamoto et al.

Furthermore, since claims 3 to 10 depend on amended claim 1, the present inventions according to claims 3 to 10 also have the features A to C according to claim 1 of the present invention. Thus, the present inventions according to claims 3 to 10 also is not obvious in view of Sakamoto et al.

The Examiner rejected claim 9 under 35 USC 102 as being anticipated by Yamaguchi et al.

Yamaguchi et al. never mentions nor remotely suggests at least the features A and C according to claim 1 of the present invention.

In contrast, since claim 9 depends on amended claim 1, the present invention according to claim 9 also has the features A to C according to claim 1 of the present invention. Thus, the present invention according to claim 9 is not anticipated by Yamaguchi et al.

As mentioned above, none of JP 2002-154840, Ishida et al., Mitachi et al., Sakamoto et al., nor Yamaguchi et al. suggests regarding at least the feature C of the present invention. Therefore, none of the cited documents provide the advantages a to d of the present invention. Thus, the present invention is not the same as Yamaguchi et al. nor JP 2002-154840 and also is not obvious in view of Ishida et al., Mitachi et al., nor Sakamoto et al.

Accordingly, Applicant submits that claims 1 and 3-10 are patentable over the cited references, taken singly or in combination. Early allowance of the claims is respectfully requested.

Respectfully submitted,  
AKIHIKO SAKAMOTO ET AL.



COLLARD & ROE, P.C.

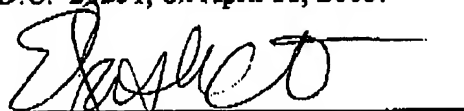
1077 Northern Boulevard  
Roslyn, New York 11576  
(516) 365-9802  
ECR:lh

Elizabeth C Richter,  
Reg. No. 35,103  
Allison C. Collard, Reg.No.22,532  
Edward R. Freedman, Reg.No.26,048  
Frederick J. Dorchak, Reg.No.29,298  
William C. Collard, Reg.No. 38,411  
Attorneys for Applicant

**CERTIFICATE OF FACSIMILE TRANSMISSION**

Fax No. 703-872-9306

I hereby certify that this correspondence is being sent by facsimile-transmission to the Assistant Commissioner for Patents, Washington, D.C. 20231, on April 11, 2005.

  
Elizabeth Collard Richter